

# **Decision Tree for Initial Responses to Potentially Harmful Algae Bloom (HAB) Reports**

## **Revised Sept. 13, 2022**

### **Introduction and Statement of Use**

This decision tree provides direction for conducting investigations of potentially harmful algal blooms (HABs) in response to complaints from the public or conditions observed in the field. The decision tree is used after it has been determined that a field response by Virginia DEQ is warranted. The agency's response to potential HAB events is determined on a case-by-case basis, by regional office management, depending on available resources and personnel. The agency prioritizes responses within the recreation season (May 1- October 31), for publicly-accessible water bodies. Regardless of whether a response by DEQ is initiated, all reports or observations of potential HABs should be documented using the HAB Task force online reporting form:

<https://www.vdh.virginia.gov/waterborne-hazards-control/harmful-algal-bloom-online-report-form/> .

The decision tree is most appropriate for initial investigations, where the objective is initial characterization of the severity of the bloom. The procedures used for follow-up investigations may differ substantially from those presented here, as the monitoring objective shifts from initial characterization of the bloom, to determining its spatial and temporal extent. The spatial extent, frequency and total effort allocated to follow-up monitoring cases will be determined by DEQ, in conjunction with the Virginia HAB Task Force, based on monitoring results and availability of qualified staff and resources.

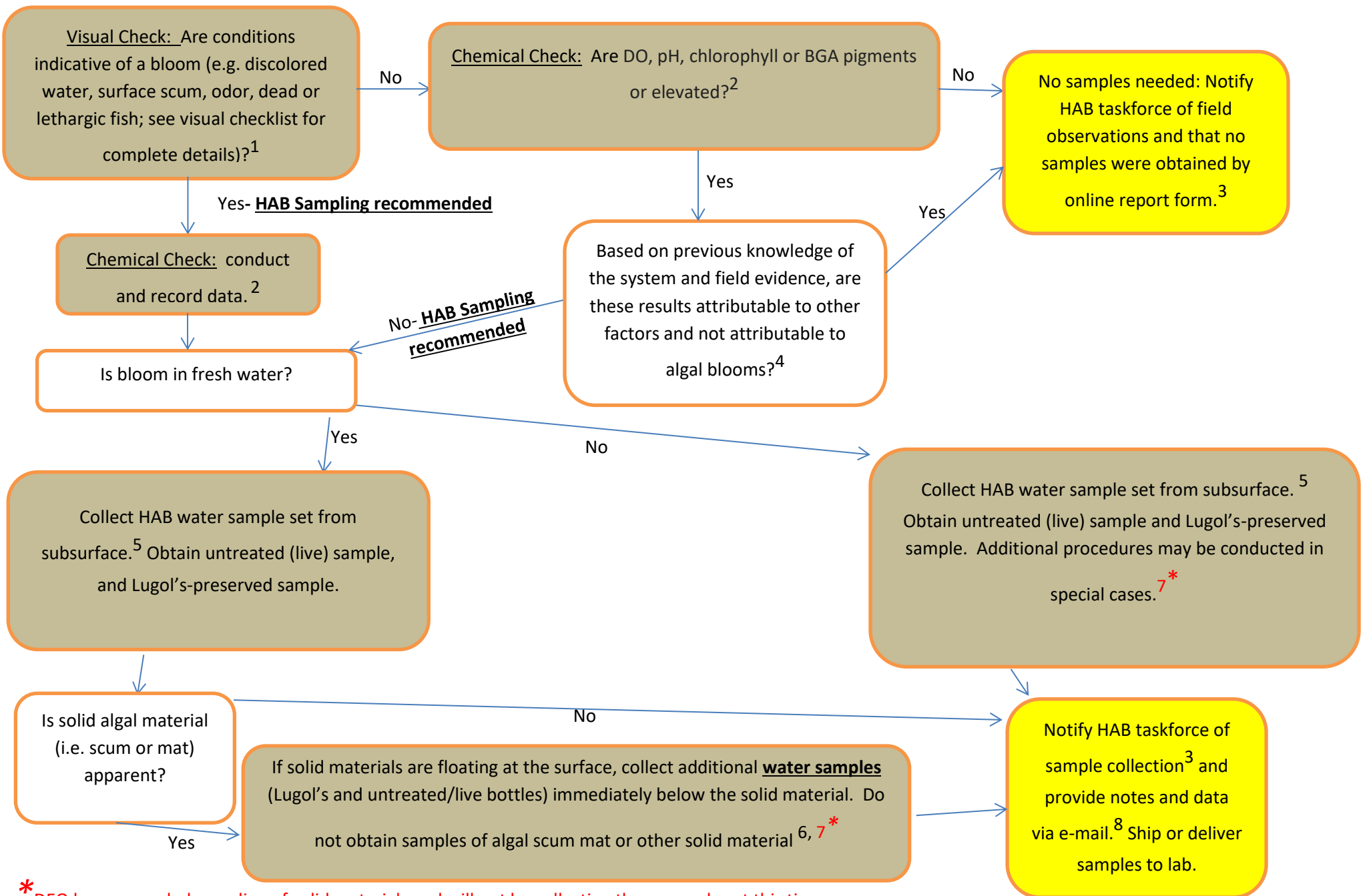
This document is intended to provide a decision support tool for trained water quality monitoring staff. It should not be used as a sole resource by investigators who are not experienced in the monitoring of HABs. Inexperienced staff should be accompanied in the field by, and work only under the supervision of, experienced personnel who are familiar with DEQ and Virginia HAB Task Force monitoring protocols. The decision tree is not intended to replace the best professional judgement of experienced monitoring staff. Practices in the field may deviate from those presented here, based on staff knowledge of previous monitoring results and site-specific conditions. In such instances, it is most important that the practices employed in the field, and the rationale for their employment, be clearly documented.

#### **Changes in this revision:**

The agency has suspended solid algal material sampling for the 2022 monitoring season. Samples of algal scums and mats, which were previously included in some HAB investigations, will not be included in future investigations until additional procedures are developed to collect and interpret data from such samples. Should such developments occur, they will be incorporated into future revisions of this document. This revision includes procedural changes associated with suspension of solid material sampling and the rationale for this change.

# Decision Tree for Initial Responses to Potentially Harmful Algae Bloom (HAB) Reports **Revised Sept. 13**

## Field Investigation Decision Tree



\* DEQ has suspended sampling of solid materials and will not be collecting these samples at this time.

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### Supporting Information

**1. Visual check.** Please include information collected during the visual check on the potential HAB investigation data sheet: Section 1: Field Observations. The following are general criteria that indicate that a potential HAB has occurred. These criteria should be used to determine whether or not to conduct a field investigation based on the answers from the citizen making the complaint and to determine when HAB sampling is warranted based on observations made in the field. The final decisions as to whether to investigate and to sample should be based on the overall judgement of experienced field personnel, but in most cases, answering “yes” to one of the conditions is grounds for conducting an investigation or obtaining HAB samples.

- Is water discolored (often green in fresh water and brown/red/mahogany in estuarine water – but may vary significantly)?
- Does water appear thick or “soupy”?
- Is there a surface algal scum (often green or yellow-green, may be red, brown or blue), solid algal material or masses on the surface, suspended in the water column, or on the benthos?
- Is there an appearance of green paint on the water surface?
- Is water clarity reduced (may not be applicable if high turbidity is attributable to a recent precipitation event)?
- Is there an earthy or musty odor near the water?
- Are dead or lethargic fish or other organisms observed that cannot be clearly attributed to another cause (e.g. cold or heat shock, chlorine)? **If dead or injured animals are observed on site notify DEQ PREP staff immediately. If the cause of the dead or injured animals is unknown, pause field activities until it is determined.**

**2. Chemical check.** Please include information collected during the chemical check on the potential HAB investigation data sheet: Section III: Field Data. DO and pH measurements are standard for HAB investigations. BGA pigments (phycocyanin in fresh water and phycoerythrin in salt water) and chlorophyll should be recorded if field probes are available. Answering “yes” to one of the below conditions is generally grounds for conducting HAB sampling. These conditions are usually associated with one or more of the visual check conditions, but not always. Conditions other than algal blooms may result in similar indications; therefore, the investigator may choose not to sample if chemical conditions are attributable to other factors. Familiarity with DO, pH, BGA pigment and chlorophyll values that occur in the water body in the absence of algae blooms is most helpful, as all can vary widely among systems and in time. Without laboratory confirmation and correction, BGA pigment and chlorophyll values should be used only for

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comparison to other values from the same system. In such cases, they can be used to roughly estimate changes, but likely do not represent absolute pigment concentrations in the water column. Chemical checks:

- Is dissolved oxygen super-saturated (i.e. above 100% saturation, especially on sunny days during the peak of photosynthetic activity/midday early afternoon)?
- Is pH elevated above what is normally observed?
- Are BGA pigment or chlorophyll levels elevated?

**3. Notifications** regarding all activities conducted as part of the HAB task force should be made via the online reporting form:

<https://www.vdh.virginia.gov/waterborne-hazards-control/harmful-algal-bloom-online-report-form/>

**4. Some conditions other than algae may result in conditions similar to a bloom.** For example, vascular plants may cause elevated DO or pH levels. Obtaining measurements in open water, away from vascular plant beds may help confirm the cause of the elevated DO or pH. Lower values obtained away from the plant beds would provide evidence that vascular plants, rather than algae, are the causes of the elevated DO or pH. Whenever possible knowledge of the chemical conditions typical of the water body should be used when evaluating chemical checks. If the observed water quality results cannot be clearly attributed to factors other than algae, HAB samples should be obtained. If samples are not obtained, the rationale for not sampling should be documented in field notes and this information should be included in follow-up through the online report form.

**5. Obtaining water samples from the subsurface.** The notes below are for the general procedures followed by DEQ for HAB investigations. The sampling approach may be modified for special circumstances in the field. For questions regarding the best sampling approach, contact the ODU Phytoplankton Lab ([phytolab@odu.edu](mailto:phytolab@odu.edu); 757-683-4994) or the laboratory that will be conducting the analyses. For further information, see HAB Task Force Standard Operating Procedures: <http://www.vdh.virginia.gov/content/uploads/sites/12/2017/07/Harmful-Algae-Bloom-Sample-Collection-Protocol-for-Virginia-Waters-FINAL-VERSION-Aug-13-2018.pdf>. Please document all samples collected on the potential HAB investigation data sheet: Section IV: Sample Information. **Thoroughly review safety reminders (top of page 5) before sampling.**

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### **Safety reminders:**

- If dead or injured animals are observed on site notify DEQ PREP staff immediately. If the cause of the dead or injured animals is unknown, pause field activities until it is determined.
- Wear nitrile or latex gloves when collecting samples
- Wear waders when wading. Always be safe when using waders; avoid deep and/or fast flowing waters use a wading belt, and do not wade alone.
- Avoid contact with algal scum as much as possible
- Avoid inhaling spray or allowing spray to come into contact with eyes (e.g. sampling by boat)
- Do not ingest water or allow it to come into contact with skin
- Wash hands and sampling equipment after each sampling event

### **The following samples are generally collected for phytoplankton water samples:**

- One, 500mL Nalgene Bottle with Lugol's solution (see Sample Preservation/Handling instructions item b)
- One, 250mL amber glass bottle, filled with water and untreated (for toxin analysis- often not required in brackish and salt water). Contact the analytical lab before submitting samples if there are any questions or concerns.
- In tidal waters, two 500mL cubitainers may take the place of the bottles described above, one untreated (live) and one fixed with Lugol's ((see Sample Preservation/Handling instructions item b)

Other methods for collecting uncontaminated water samples may be substituted for those presented here (e.g. Kemmerer bottles). Follow DEQ protocol and equipment manufacturer's instructions when other methods are used. If needed contact the analytical lab to ensure that the chosen sampling methods are appropriate.

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**Method 1 Sampling with submersible pump.** Typical on larger boats. A sampling rod (Method 2 below) may also be used from boats.

- a) Using pump and hose assembly if available, lower intake hose to sampling depth (typically 0.3m below the surface)
- b) Completely clear the hose
  - i) Turn the pump on and draw the end of the intake hose above the water surface to place air into the hose
  - ii) Lower the intake end to the desired sample depth and watch for the air to completely exit the hose, and wait an additional 30 seconds
- c) Once hose has been properly cleared, begin sample collection
  - i) Using protective gloves, open lid and fill containers to near the neck
- d) Repeat this procedure for both (untreated (live) and preserved) and add Lugol's solution to the preserved sample as in described in the Sample Preservation/Handling instructions below (item b).
- e) Follow instructions for packing and shipping in Sample Preservation/Handling instructions below (item c)

**Method 2 Sampling Rod.** May be used while wading from a dock, shore, or by boat.

- a) Avoid disturbing sediment or collecting excess vegetation (e.g. duckweed) if possible
- b) Using a sample rod to secure the container in place, remove the lid and position the rod so that the container is inverted
- c) Lower the bottle to a depth of 0.3m and revert the bottle, bringing it back to the surface
- d) Replace the container cap
- e) Repeat this procedure for both samples (untreated (live) and preserved) and add Lugol's solution to the preserved sample as in described in the Sample Preservation/Handling instructions below (item b).
- f) Follow instructions for packing and shipping in Sample Preservation/Handling instructions below (item c).

**Method 3 Hand Collection\***

- a) Avoid disturbing sediment or collecting excess vegetation (e.g. duckweed) if possible
- b) Wearing elbow length protective gloves, remove the lid and invert the sample container
- c) Lower the container through the water column to a depth of about 0.3m, taking care not to expose skin to the water
- d) Revert the container and raise back through the water column

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- e) Replace the container cap
- f) Repeat this procedure for both samples (untreated (live) and preserved) and add Lugol's solution to the preserved sample as in described in the Sample Preservation/Handling instructions above (item b).
- g) Follow instructions for packing and shipping in Sample Preservation/Handling instructions below (item c).

\*Always wear waders when entering the water and protective gloves to minimize exposure

### **Sample preservation/handling**

- a) Labeling. Identify each sample container with a sample tag. Field parameter readings should be included on the tag or an accompanying data sheet. Include at a minimum:
  - i. Location (ideally with coordinates)
  - ii. Sample date/time,
  - iii. Sample depth (surface scum or subsurface)
  - iv. Preservative type (or "none")
  - v. Toxin analyses requested (not necessary for standard freshwater samples; follow up with analytical lab and project manager if needed)
- b) Preserving with Lugol's solution
  - a) Add Lugol's iodine solution using a dropper bottle, taking care to avoid contact with skin
  - b) The final color should resemble a weak tea or whiskey. A ratio of about 1:100 is typically sufficient. For a 500mL container, 5mL would achieve that ratio. A disposable graduated pipette may aid in this process.
  - c) Sample should be stored out of sunlight. It is not essential to ice the treated sample but this is typically done to consolidate the samples.
- c) Packing and shipping
  - a) Unpreserved samples should be packed in a cooler on ice, with a barrier between preserved samples and ice to prevent direct contact. Preserved samples may be packed in the cooler or separately.
  - b) Samples should be shipped overnight (expedited delivery) to ensure delivery to the lab within 24 hours.

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**6. Obtaining water samples from the surface**. Please characterize the extent of the scum layer on the potential HAB investigation data sheet: Section II: Bloom Extent Characterization and document samples collected in Section IV: Sample Information. **Thoroughly review safety reminders (top of page 5) before sampling.**

- a) Always wear protective gloves to avoid exposing skin to the water
- b) Gently sweep away detritus at the water surface with a gloved hand. Move aside dead algal material and any other detritus floating on the surface that is not suspended in the water column. Avoid disturbance of the water column as much as possible.
- c) Position the bottle parallel to the water surface (cap already removed), gently tilting the bottle into the water to capture the top 3-5cm of the water column at the water surface.
- d) Revert the bottle and remove from the water, replacing the cap.
- e) Repeat this procedure for each of the two samples (preserved and untreated (live/toxin)) and add Lugol's solution to the preserved sample as in described in the Sample Preservation/Handling instructions above (item b).
- f) Follow instructions for packing and shipping in Sample Preservation/Handling instructions above (item c).

For further information, see HAB Task Force Standard Operating Procedures:

<http://www.vdh.virginia.gov/content/uploads/sites/12/2017/07/Harmful-Algae-Bloom-Sample-Collection-Protocol-for-Virginia-Waters-FINAL-VERSION-Aug-13-2018.pdf>.

**7. Solid algal material.** In past investigations the agency has collected solid algal material to confirm the presence or absence of toxins and potentially toxic algal species. Due to personnel and resource limitations, lack of published and widely accepted criteria for evaluating solid material and a lack of safe, consistent, quality assured methodology for both collecting and analyzing this material, DEQ will not be collecting these samples at this time. If these logistical challenges are overcome, this section will be revised to include detailed protocols for collection of solid material, developed with input from HAB task force partners.

**8. E-mail notifications** on HAB investigation activities should include the ODU phytoplankton lab: [phytolab@odu.edu](mailto:phytolab@odu.edu), Todd Egerton: [todd.egerton@vdh.virginia.gov](mailto:todd.egerton@vdh.virginia.gov), Margaret Smigo: [Margaret.Smigo@vdh.virginia.gov](mailto:Margaret.Smigo@vdh.virginia.gov), Drew Garey: [andrew.garey@deq.virginia.gov](mailto:andrew.garey@deq.virginia.gov), Andrew Kirk: [andrew.kirk@deq.virginia.gov](mailto:andrew.kirk@deq.virginia.gov) and the appropriate regional office WQMA manager. Others may be notified on a case-by-case basis.



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### Example HAB Investigation Field Sheet

PROGRAM CODE	COLLECTOR	UNIT CODE	DATE COLLECTED	TIME
STATION	DESCRIPTION		LATITUDE*	LONGITUDE*

\*Location of algae samples (if collected) and field water quality data.

WEATHER	TIDE	SECCHI DEPTH(m)	SAMPLE COLLECTION METHOD (if water samples were collected)

Section I: Field observations			
<p><b><u>Visible signs of algae or odor detected:</u></b></p> <p>If yes, please describe visual signs, including water color and clarity and describe odor if detected.</p>	<input type="checkbox"/> yes	<input type="checkbox"/> no	
<p style="text-align: right;">Dead fish present*:</p> <p>*Note: if dead fish observed, consult DEQ Fish Kill Monitoring Guidance and consider initiating a fish kill response investigation.</p>	<input type="checkbox"/> yes	<input type="checkbox"/> no	<p>If yes, list taxa and number of each (use additional notes section on page 5 if needed).</p>

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Were dead fish collected?	<input type="checkbox"/> yes	<input type="checkbox"/> no	If yes, list taxa, number of each, lab to which samples were transported, and analyses ordered (use additional notes section if needed).
Scum layer observed?	<input type="checkbox"/> yes	<input type="checkbox"/> no	If yes, please document extent of scum layer (Section II), obtain surface water column samples from just below the scum layer and document samples (Section III).

### Section II: Bloom Extent Characterization

To be completed if scum layer or other signs of an extensive bloom are observed.

If solid algal material is observed, describe as completely as possible. Solid material may include a scum layer, or discrete clumps at surface or benthic mats. **Obtain photographs** and include a common object (e.g. meter stick) to provide scale if possible. Provide written answers to the questions below or include information on a diagram as needed. See example diagram on page 5.

Color of scum layer/solid material?

Approximate thickness of scum or benthic mat? Is scum layer or benthic mat uniform or patchy?

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What was the approximate surface area investigated? This may be estimated in the field for small areas, or evaluated using GIS or map resources. If using GIS, note the water body name or provide a diagram so that the area may be easily located on-screen.

What percentage of the area investigated (or total surface area) was covered by scum or benthic mat? (It is not unusual if this may be difficult to determine in a single site visit during a rapid response)

Where was the scum layer or solid material located within the water body?

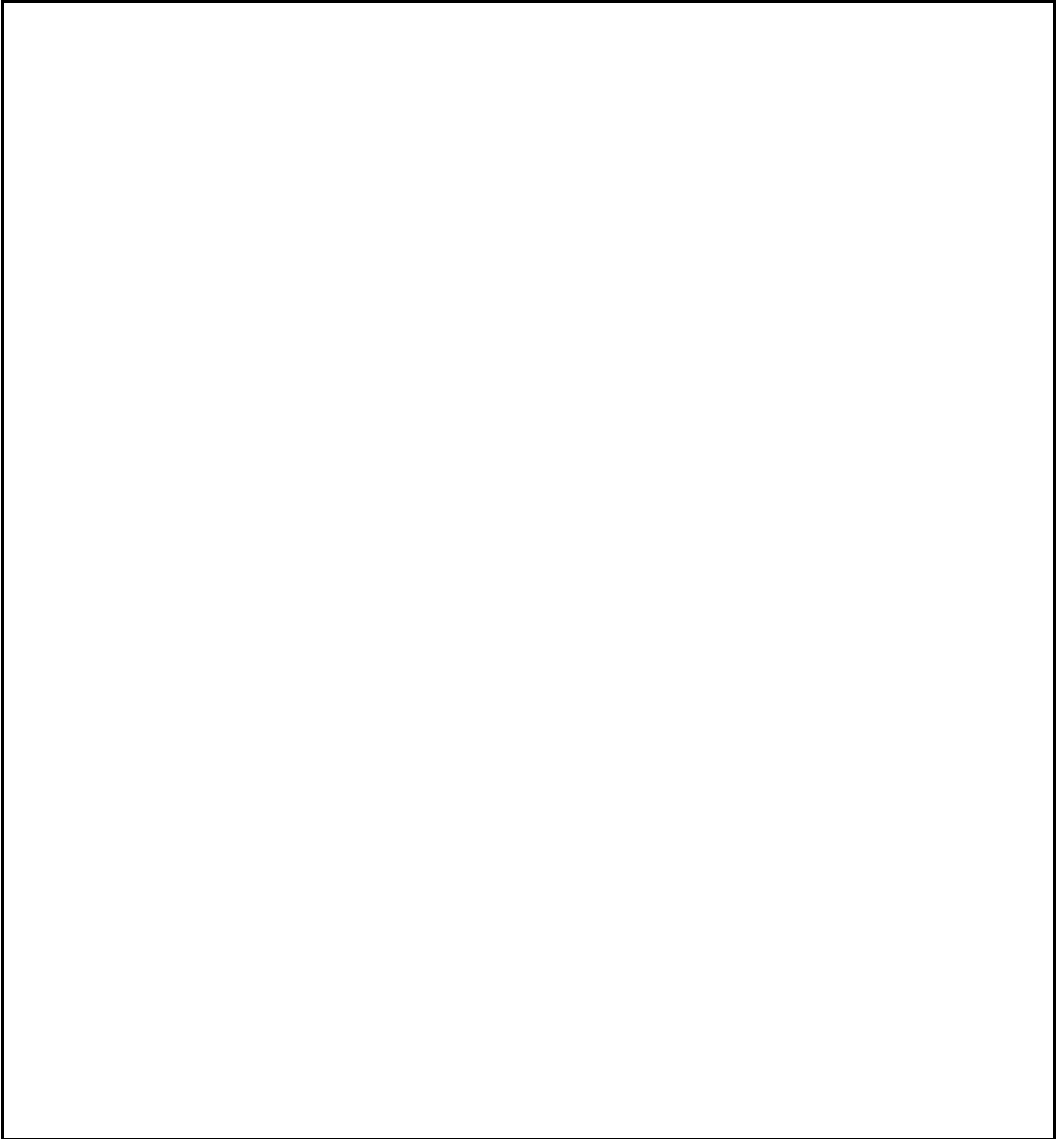
Note the location of scum or solid material samples in the water body in relation to any subsurface samples obtained. if not the same.

What was the appearance of the subsurface water beneath the scum layer or associated with solid material?

Example notes: "Investigated bloom in Wyrick Cove. Total surface of cove approximately 100m<sup>2</sup>. Scum layer confined to 0.5 meter-wide band along shoreline comprising 1-2% of total surface area of cove. Scum layer 1-2 cm thick. Subsurface below scum water clear, with low turbidity. Obtained surface water samples just below the scum layer approximately 10m north of subsurface sample location "

If needed, use the space below to provide the above information in a diagram or to note other information related to the extent of the bloom.

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[illegible]

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BOTTOM DEPTH :									

\*Optional parameter \*\*Optional parameters. If used, please indicate whether chlorophyll and blue-green algae (BGA) sensor has been calibrated with Rhodamine Dye and whether BGA sensor measured phycocyanin (freshwater BGA) or phycoerythrin (marine)

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Section IV: HAB water sample information			
Algal Samples			
Depth (m)	Preserved sample (note preservative and container)	Live sample (note container)	Toxin sample (note container and toxins to be evaluated)
0.3 (standard subsurface)			
Lab name			
Comments			
Scum (surface water)			
Lab name			
Comments			
Other- Indicate Depth:  _____			
Lab name			
Comments			
Other- Indicate Depth:  _____			
Lab name			

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Comments				
<b>Water quality samples collected (optional)</b>				
<b>Depth</b>	<b>Parameter(s)</b>	<b>Lab name</b>	<b>Group code</b>	<b>Comments</b>

**Additional notes:**